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(54) **High-density fibre cable management system**

Faseroptisches Verteilersystem

Sytème à repartir fibres optiques

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Description

[0001] This invention pertains to the telecommunications industry. More particularly, this invention pertains to a high-density fiber distribution frame for use in the telecommunications industry.

[0002] In the telecommunications industry, use of fiber optic cables for carrying transmission signals is rapidly growing. To interconnect fiber optic equipment, fiber distribution frames have been developed. An example of a prior art fiber distribution frame is shown in commonly assigned U.S. Patent No. 4,995,688.

[0003] The fiber distribution frame of U.S. Patent No. 4,995,688 includes a so-called connector module (item 16 in the '688 patent) having a front panel which carries a plurality of adapters (102). Each of the adapters (102) permits attachment of a fiber optic connector (100) to both sides of the adapter in order to optically connect two fiber optic cables.

[0004] Typically, the back side of the adapters (102) are provided with connectors secured to fiber optic cables. The cables are connected to various pieces of fiber optic equipment (such as, a fiber-to-copper convertor for converting DS-3 signals to optical signals).

[0005] The connectors on the back side of the adapters are semi-permanent. Namely, while the connectors on the back side of the adapters can be easily removed, they are normally installed with the intent to maintain the connection of the connector to the rear side of the adapter without frequent future changes to the connection. On the front side of the adapter, the fiber optic connector is secured to a fiber cable (for example, a jumper cable) for cross-connecting to other pieces of optical equipment or to any other destination.

[0006] WO-A-91 10927 relates to an optical fiber cable distribution frame including a housing containing a plurality of shelves. Each shelf is pivotally attached, at one front corner, to the housing for pivotal movement into and out of the housing. The shelf 162 shown in Figure 16 includes storage spools 194 and an elongate panel 202 supporting optical connector sleeves 210 that are spaced along its length.

[0007] With the increase in use of fiber optic cables in the telecommunications industry, it is desirable to provide fiber distribution frames with increased density. By density, it is meant the number of locations per unit volume of unit area for providing connection on the fiber distribution frame.

[0008] In products made according to the aforementioned U.S. Patent No. 4,995,688, a typical fiber distribution frame will have about 576 fiber optic connector locations. In the industry, it is becoming desirable to substantially increase the density to be in excess of 1,400 connectors per frame.

[0009] Examples of high-density fiber distribution frames include a frame marketed under the trademark of Fiber Manager by Northern Telecom and described in Northern Telecom Bulletin No. 91-004, Issue No. 2, May, 1991. Another example includes the High Density Interconnect System (HDIC) of AT&T as disclosed in its Product Bulletin 2987D-DLH-7/89, Issue 2.

[0010] One problem associated with prior art high-density fiber distribution frames is that the prior art products require substantial displacement of fibers when access to the fiber connectors is required. For example, the Northern Telecom product houses the fibers and connectors in a molded plastic cassette. The cassette is shown on page 7 of the aforementioned Northern Telecom publication. The particular cassette shown has twelve connectors (paired into six connections). To access any one of the twelve connectors, the cassette must be pulled from the frame approximately three to four inches at which point the cassette drops to an access position as shown on page 6 of the aforementioned bulletin. As a result, even though only one connector may require access, a total of twelve connectors are displaced with substantial displacement of the fiber optic cables associated with each of the twelve connectors.

[0011] Unnecessary or excessive displacement of fiber optic cables is undesirable. As fiber optic cables are displaced, they are subject to bending and other forces. As a fiber bends, the fiber can break resulting in loss of transmission through the fiber. Since fibers carry extremely high signal rates, the breakage of a single fiber can result in a substantial loss of data or voice communications. Telecommunications industry standards generally recognize a minimum bending radius of about one and a half inches for optical fibers.

[0012] It is an object of the present invention to provide a fiber distribution frame which permits high density, ready access to fiber optic connectors and minimal displacement of fibers when access is being made to connectors.

[0013] The present invention provides a signal transmission cable management system as set forth in claim 1 and comprising:

> a fixture; and
> a plurality of adaptor modules mounted on said fixture, each module being individually movably mounted on said fixture for movement along a line of travel,
>
> wherein each one of said adaptor modules includes a plurality of adaptors, each adaptor having opposite ends for coupling to a cable connector and each one of said adaptors being movable with said one of said modules along said line of travel; and,
>
> wherein said plurality of adaptors are mounted in a linear array defining a longitudinal axis for each of said modules, and said modules are mounted on said fixture in side-by-side relation with said longitudinal axes generally parallel to said line of travel.

[0014] The present invention further provides an adaptor module as set forth in claim 13, the adaptor module arranged for mounting in a signal transmission

cable management system having a fixture including a plurality of spaced apart walls defining a plurality of parallel spaced apart cavities for receiving the modules, wherein said adaptor module is of hollow construction and comprises a plurality of adaptors mounted in a linear array defining a longitudinal axis for said module, each adaptor having opposite ends for coupling to a cable connector, said module being provided with means for individually movably mounting the module on the fixture for movement along a line of travel generally parallel to said longitudinal axis, each one of said adaptors being movable with said module along said line of travel.

[0015] There is additionally provided a method of connecting fiber optic cables in a signal transmission cable management system as set forth in claim 15 and comprising:

providing a plurality of adaptor modules, each one of said adaptor modules including a plurality of adaptors mounted in a linear array defining a longitudinal axis for each of said modules, each adaptor having opposite ends for coupling to a cable connector, and

mounting said plurality of adaptor modules on a fixture so that each of said adaptor modules is individually movably mounted on said fixture for movement along a line of travel, said modules being mounted on said fixture in side-by-side relation with said longitudinal axis generally parallel to said line of travel, each one of said adaptors being movable with said one of said modules along said line of travel.

[0016] The fixture may include a plurality of spaced-apart walls, opposing pairs of said walls defining a plurality of channels, each of said modules being disposed within a respective channel, cooperating guide means for each of said modules and said walls for attaching said modules to said walls and accommodating movement of each of said modules along said line of travel.

[0017] Releasable lock means for releasably locking each of said modules in any one of a plurality of fixed positions along said line of travel may be provided. Each of said plurality of fixed positions may include a first, second and third position, each linearly separated along said line of travel. The system may include a forward wall disposed, spaced from and opposing said front sides of said modules, said modules shielded by said strip when said one of said modules is in said first position and with a first portion of said one of said modules exposed above an upper edge of said wall when said one is in said second position and with a second portion of said one exposed below a lower edge of said strip when said one is in said third position.

[0018] The lock means may include a locking member on each of said modules, said locking member moveable between a locked position and an unlocked position; said walls and said locking member including cooperating elements for restraining said modules for movement along said line of travel at each of said plurality of fixed positions when said locking member is in said locked position and accommodating movement of said module along said line of travel when said locked member is in said unlocked position.

[0019] The cooperating guide means may include a rail on each of said modules and a mating groove on at least one of said walls opposing each of said channels with said rails slidably received within said groove and with said rails sliding within said groove along said line of travel.

[0020] The above-mentioned cooperating elements may include a detent formed in said walls and corresponding with said plurality of fixed positions, said locked member including an edge sized to be received within said detent when said lock member is in said locked position and said edge removed from said detent when said lock member is in said unlocked position. Preferably, the lock member is biased toward said locked position.

[0021] The system may comprise a frame having mounting means for mounting said fixture in said frame; said mounting means including a pivot attachment for said fixture to pivot relative to said frame about said pivot axis. Preferably, said pivot axis is generally perpendicular to said line of travel. The mounting means may further include a frame lock for releasably locking said fixture in any one of a plurality of pivoted positions about said pivot axis.

[0022] In a preferred embodiment of the present invention, a cable management system is provided which includes a fixture having a plurality of modules mounted on the fixture. Each of the modules is moveable on the fixture for movement along a line of travel. A releasable lock mechanism is provided for releasably locking each of the modules in a plurality of fixed positions along the line of travel. A plurality of adaptor means or mating elements is secured to each of the modules for movement therewith. The mating elements each includes means for connecting a first signal transmission cable at a rear side of the element with a second signal transmission cable at a front side of the element.

[0023] A preferred embodiment constructed in accordance with the present invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a front, top and right side perspective view of a fiber distribution frame constructed according to the present invention;

Fig. 2 is a top, front and right side perspective view of two mounting fixtures according to the present invention enjoined by common mounting bracket;

Fig. 3 is a top plan view of the mounting fixtures of Fig. 2;

Fig. 4 is a view similar to Fig. 2 showing a right mounting fixture pivoted to a down position;

Fig. 5 is a top, front and right side perspective view of a left mounting fixture removed from a mounting bracket;
Fig. 6 is a right side elevation view of the mounting fixture of Fig. 5;
Fig. 7 is a front, top and right side perspective view of a cross-connect tray including adapters;
Fig. 8 is a front, top and right side perspective view of a metallic support platform;
Fig. 9 is a front, top and right side perspective view of a left retaining wall;
Fig. 10 is a right side elevation view of the wall of Fig. 9;
Fig. 11 is an enlarged top plan view of a forward end of the wall of Fig. 9;
Fig. 12 is a front, top and right side perspective view of a intermediate retaining wall;
Fig. 13 is a right side elevation view of the wall of Fig. 12;
Fig. 14 is an enlarged top plan view of a forward end of the wall of Fig. 12;
Fig. 15 is a rear, top and left side perspective view of a right retaining wall;
Fig. 16 is a left side elevation view of the wall of Fig. 15;
Fig. 17 is a top plan view of a forward end of the wall of Fig. 15;
Fig. 18 is a view similar to Fig. 7 showing connector modules shifted;
Fig. 19 is a front, top and right side perspective view of four mounting fixtures mounted in a frame with an upper right side fixture pivoted to a down position;
Fig. 20 is a side right elevation view of the view of Fig. 19;
Fig. 21 is a front, top and right side perspective view of a connector module according to the present invention;
Fig. 22 is a front elevation view of the connector module of Fig. 21;
Fig. 23 is a view taken along lines 23-23 of Fig. 22;
Fig. 24 is a view taken along lines 24-24 of Fig. 22;
Fig. 25 is a front, top and right side perspective view of a fixture according to the present invention and connected to fiber optic cables and;
Fig. 26 is a top plan view of the fixture of Fig. 25.

[0024] With reference now to the several drawing figures in which identical elements are numbered identically throughout, a description of one preferred embodiment according to the invention will now be provided.

[0025] With initial reference to Fig. 1, a fiber distribution frame 10 is shown. The frame 10 includes spaced-apart side walls 12,14 connected at their upper ends by a top wall 16. Connected to the forward side of the top wall 16 is a trough 18 for carrying cables and the like as is conventional. The bottom of the frame 10 is provided with a pedestal 20 which also has secured to it a trough 22 for carrying cables and the like. The forward edges of the side walls 12,14 are provided with a plurality of clips 24 for holding fiber optic cables extending vertically in front of side walls 12,14.

[0026] Contained within frame 10 between side walls 12,14 are a plurality of left and right mounting fixtures 26,26' (schematically shown in Fig. 1). A detailed description of mounting fixtures 26,26' is provided elsewhere in this specification. However, the fixtures 26,26' are mounted with the fixtures 26,26' aligned in two columns of ten fixtures per column with the two columns in horizontal alignment. It will be appreciated that the specific number of fixtures 26,26' and their alignment is shown for the purposes of illustrating a preferred embodiment and a different number and alignment of fixtures can be provided within a frame 10.

[0027] The fixtures 26,26' are illustrated in Fig. 2 with the fixtures 26,26' paired in a common mounting bracket 28. The mounting bracket 28 includes first and second mounting plates 30,32 for attachment to walls 12,14 respectively. First fixed plates 34,36 are secured to each of mounting plates 30,32, respectively, with the fixed plates 34,36 disposed in parallel, spaced-apart alignment and connected by a pivot rod 38. Second fixed plates 40,42 (best shown in Fig. 4) are also fixedly secured to the pivot rod 38 with plates 40,42 disposed intermediate between plates 34,36 and parallel thereto. Plate 40 opposes plate 34 and plate 42 opposes plate 36.

[0028] A left fixture 26 is separately shown in Fig. 5. Except as will be specifically discussed, fixtures 26,26' are identical and a description of one will suffice as a description of the other. Elements of fixture 26' corresponding to elements of fixture 26 are identically numbered with the addition of an apostrophe to distinguish the fixtures.

[0029] The fixture 26 includes a metallic support platform 44 and a plastic molded cross-connect tray 46. The support platform 44 is separately shown in Fig. 8 and includes parallel side walls 45,49 spaced apart by a floor portion 47. A leading edge of the floor portion 47 is provided with parallel cut-outs 51 to define a plurality of support fingers 53.

[0030] The cross-connect tray 46 is separately shown in Figs. 7 and 18. The cross-connect tray 46 includes a flat base 48 (which is secured to floor 47 of platform 44). Intricately molded with base 48 at a rear edge thereof are clips 50 sized to snap fit onto pivot rod 38 permitting clips 50 (and hence cross-connect tray 46) to rotate or pivot about the axis (X-X in Fig. 2) of the pivot rod 38. Pivot rod 38 and axis X-X are horizontal when the mounting fixture 26 is secured within the frame 10.

[0031] The upper surface of the base 48 is provided with a plurality of triangular-shaped walls including a left wall 52a, a right wall 52b and a plurality of intermediate wells 52c. The walls 52a-52c are numbered and shown assembled in Fig. 26 and are shown separately in Figs. 9-17.

[0032] A wall is mounted on each support finger 53. The plurality of walls 52a-52c are vertical when base 48 is horizontal and each extends generally perpendicular to the pivot axis X-X of clips 50 with the walls 52a-52c disposed in spaced-apart, parallel alignment. Accordingly, opposing surfaces of each of the walls 52a-52c define a plurality of discrete channels 54. (Fig. 18). Also, opposing surfaces of each of the walls 52a-52c have formed therein parallel spaced-apart grooves 56 which extend perpendicular to the base 48.

[0033] Disposed within each of the channels 54 is a module 58. As best shown in Figs. 21-24, each of modules 58 is a generally box-like construction including side walls 60,62. Each of side walls 60,62 is provided with a projecting rail 64 sized to be sideably received within grooves 56. Accordingly, rails 64 are received within grooves 56 to permit individual movement of each of the modules 58 relative to the platform 48 only in a direction of travel A (Fig. 18) which is perpendicular to the pivot axis X-X of the clips 50. The direction of travel A is vertical when base 48 is horizontal.

[0034] The rails 64 have beveled edges which taper inwardly toward the side walls 60,62. The groove 56 are complementary shaped. Accordingly, when rails 64 are received within the grooves 56, the rails can only move in the direction of the grooves 56. This structure provides lateral support to the walls 52a-52c.

[0035] The modules 58 further include top and bottom walls 66,68 which are provided with a releasable lock mechanism 70 for independently locking each of the modules 58 in any one of a plurality of fixed positions along the line of travel A. The lock mechanisms 70 include tabs 74 secured to the walls 66,68 by hinge members 76. It will be appreciated that each of modules 58 is formed from an injection-molded plastic. The hinge member 76 is provided with a narrowed mid-point 78 (Fig. 23) to permit the material of the hinge member 76 to rotate about the mid-point 78 when an operator grasps the tab 74 and urges it toward the walls 66,68. The tabs 74 are also provided with a rear edge 80 (Fig. 23) which projects rearedly from the hinge members 76. Further, a stop 75 is provided on each of walls 66,68 to limit the stroke of tabs 74 to prevent breakage of narrowed mid-point 78.

[0036] The lock mechanisms 70 are sized such that the rear edges 80 oppose and abut the top and bottom edges 82 of the wall members 52a-52c when the modules 58 are in a first or neutral position as shown in Fig. 7. In this position, the lock members 74 are shown biased to a lock position with the rear edges 80 opposing and abutting the top and bottom edges 82 to prevent movement of the modules 58 along the line of travel A.

[0037] By pressing on the tabs 74 and urging them toward the top and bottom walls 56,68. The lock mechanisms 70 are moved from their locked position to an unlocked position with the rear edges 80 clear of the top and bottom edges 82. So cleared, the modules 58 may be individually moved either up or down (i.e., in the direction of the line of travel A as shown in Fig. 18). Centrally positioned between the top and bottom edges 82 on each of walls 52a-52c are grooves 84,85. When either of the lock mechanisms 70 is in the region of the groove 84,85, an operator may release the lock mechanism 70 such that its natural bias causes the edge 80 to be received within the grooves 84,85. Accordingly, each of the modules 58 may be locked in an up position (with edge 80 of the lower lock mechanism 70 received within lower groove 85) or in a down position (with edge 80 of the upper lock mechanism 70 received within upper groove 84).

[0038] Each of modules 58 has a hollow construction which in a preferred embodiment is sized to receive six fiber optic connector adapters disposed in an abutting linear array. In the preferred embodiment shown, the specific adapters 90 are well-known and so-called SC adapters for receiving and retaining SC connectors at opposite ends of each of the adapters 90 such that each adaptor 90 joins and optically couples two fiber optic connectors.

[0039] It will be appreciated that SC adapters form no part of this invention per se. Such adapters are commercially available, well-known items. An example of such an adaptor is shown in commonly-assigned and copending U.S. Patent Application Serial No. 08/065,139, filed May 30, 1993. Also, it will be appreciated that while SC adapters 90 are shown in use in a preferred embodiment, different types of adapters for different types of fiber optic connectors (for example, FC, D4 or other connectors) could also be utilized in the modules 58 with internal geometry of the modules 58 simply modified to accommodate different external geometry of different connector adapters.

[0040] With reference now back to Figs. 4 and 5, each of the cross-connect trays 46 is secured (through bolts or the like) to the support platforms 44. Sidewalls 45, 490 of left fixture 26 are sized to closely face walls 42,36. Side walls 45'49'of right fixture 26' are sized to closely face walls 34,40. The side walls 45,49 carry spring-loaded locking tabs 103 which can be pulled inwardly to retract a lock pin 102 (Fig. 5). Upon release of the tabs 103, the tabs 103 are spring-biased to permit locking pins 102 to protrude beyond the exterior of the side walls 45,49. Opposing surfaces of the plates 34,40, 42 and 36 are provided with detents 101 (Fig. 4) sized to receive the pins 102 such that the support platform 44 and attached cross-connect trays 46 may be rotated about pivot rod 38 to any one of a plurality of rotated positions and fixed in place in the fixed position. Fig. 4 shows a mounting fixture 26 in a horizontal position and a second mounting fixture 26' rotated about pivot rod 38 to a down position.

[0041] The forward edge of each of the support platforms 44 is provided with extension side walls 100,102 which extend from the side plates 45,49. The extension walls 100,102 extend forwardly beyond the front side of the adapters 90 by a distance sufficient to permit con-

nectors to be inserted within the adapters 90 as will become apparent.

[0042] The extension walls 100,102 are joined by a forward wall 104. Extending upwardly from forward wall 104 is a designation plate 106 which provides a flat surface generally parallel to the plane of the front ends of the adapters 90. The flat surface of the designation plate 106 provides a surface on which a designation strip can be attached to permit an operator to place identifying information or the like. The plate 106 also protects the adaptors 90 and attached connectors and fibers from physical damage.

[0043] Secured to the forward wall 104 and spaced between the designation plate 106 and the adapters 90 are a plurality of arcuate fanning clips 108. For the left side fixtures 26, the fanning clips 108 are arced to direct fibers from the adapters to the left side of the frame. For the right side fixture 26', the fanning clips 108 are oriented to direct fibers from the adapters 90 to the right side of the frame. Further, each of the fixtures 26 is provided with a radius plate 110 with an attached fanning clip 112. The plate 110 permits fibers to be draped downwardly through clip 112 with the radius 110 limiting the bending of the fibers to prevent excess bending.

[0044] Connected to the fixture 26 on the rear side thereof may be provided any one of a plurality of different styles of cable management fixtures 120. The cable management fixtures 120 shown in Fig. 4 includes a plurality of fanning clips for cable management as well as takeup spools for taking up excess amounts of cable. It will also be appreciated that the rear area of the fixtures 26 can be provided with a variety of different cable management devices including splice trays or the like.

[0045] With reference now to Figs. 25-26, the reader will note use of the fixture 26 in use for organizing and cross connecting a plurality of optical fibers. Equipment fibers 130 enter the rear of the fixture 26 with excess fiber lengths wrapped around the cable management device 120. The equipment fibers 130 may originate from any one of a plurality of different types of fiber optic equipment such as fiber-to-copper convertors. Each of the fibers 130 is terminated at an SC connector 132. The connector 132 is received within the back end of adapters 90. Cross-connect fiber cables (frequently referred to as jumpers) 140 are passed through clip 112 and individually fanned by fanning clips 108 toward adapters 90. Each of the fibers 140 terminates at an SC connector 142 which is each received within the forward end of an adaptor 90 such that each one of connectors 132 is individually connected to a singular one of a plurality of connectors 142.

[0046] From time to time, it is desirable to replace or move the cross-connect cables 140. If the cables or connectors of the top three adaptors of a given module 58 are desired to be accessed, the operator grasps the locking tabs 74 and moves the module upwardly to the position of the raised module 58 shown in Fig. 25. In this position, each of the top three of the connectors 142 of the module is readily accessible without interference from the designation strip 106. If the bottom three of the connectors 142 of the same module 58 are to be accessed, the operator simply engages the tabs 74 and moves the connector downwardly until the top tab 74 is received within the groove 84 to lock the module 58 in the down position. In the down position, the bottom three of the connectors 142 is accessible beneath the designation strip 106 without interference from the designation strip 106. When no connectors are to be accessed, the module 58 is placed in its neutral position with all of the connectors 142 protected from impact or other interference by means of the designation strip 106 and the forward wall 104.

[0047] The reader will note that in order to obtain access to any one of the connectors 142 in a module 58, the module 58 is only moved a very small distance. Also, only six adaptors 90 are moved at a time. The very small movement associated with accessing each of the connectors results in a minimal probability of damage to any one of the fiber optic cables.

[0048] The benefits of the present invention include limited displacement of the fibers. In the prior art, when a tray containing several connectors is moved, the fibers are displaced axially by a substantial amount (e.g., about 3 inches). In the present invention, as a module 58 is moved up or down (about 1.5 inches) the fiber experiences very little axial movement with most of the movement accommodated by a lifting or lowering movement of the fiber transverse to the fiber's axis.

[0049] While the back connectors 132 are semi-permanently installed, it is desirable, from time to time, to be able to have access to the connectors 132 (particularly when the connectors 132 are initially installed). However, if access to back connectors 132 is desired, they may be accessed the same as the front connectors 142 (i.e., by raising or lowering modules 58).

[0050] In certain installations, only the front of frame 10 is accessible to an operator. In such installations, access to the cable management device 120 is obtained through the tilt feature of the fixture 26. Namely, to obtain access to the cable management device 120 from the front of frame 10, the tabs 103 are pulled inwardly to retract lock pins 102. With the pins 102 retracted, the entire fixture 26 rotates about the pivot rod 38 to a down position as shown by fixture 26' in Fig. 4. In the down position, the cable management device 120 is readily accessible to an operator facing the front of the frame 10.

[0051] Other modifications of the invention may be apparent to one skilled in the art. For example, in the preferred embodiment illustrated, a module 58 with all six adaptors 90 is moved up or down from the neutral position. Alternatively, the module 58 could be split in half with the top half moved up to access the top three connectors and with the bottom half independently moved down to access the bottom three adaptors.

[0052] Also, as an alternative, the modules 58 can be

provided with additional functions. In the preferred embodiment illustrated, the modules 58 retain only adaptors 90. However, modules 58 can include products other than adaptors 90. For example, modules 58 may house optical splitters, WDM's (wave division multiplexers) or other equipment. While adaptors 90 may be used with such enhancements, adaptors 90 may not be necessary (e.g., such enhanced modules may be provided with fiber pigtails).

[0053] From the foregoing detailed description of the present invention, it has been shown how the objects of the invention have been attained in a preferred manner. However, modifications and equivalents of the disclosed concepts, such as those which readily occur to one skilled in the art, are intended to be included within the scope of the claims which are appended hereto.

Claims

1. A signal transmission cable management system comprising:

   a fixture (26); and
   a plurality of adaptor modules (58) mounted on said fixture, each module being individually movably mounted on said fixture (26) for movement along a line of travel (A),

   wherein each one of said adaptor modules (58) includes a plurality of adaptors (90), each adaptor having opposite ends for coupling to a cable connector and each one of said adaptors (90) being movable with said one of said modules along said line of travel; and,

   wherein said plurality of adaptors (90) are mounted in a linear array defining a longitudinal axis for each of said modules, and said modules are mounted on said fixture in side-by-side relation with said longitudinal axes generally parallel to said line of travel (A).

2. A system according to claim 1, wherein each of said plurality of adaptors (90) couples first and second fiber optic cable connectors.

3. A system according to any one of the preceding claims, wherein said fixture (26) defines a plurality of channels (54), each of said adaptor modules (58) being disposed within a respective channel, and further comprising cooperating guides (56,64) on each of said modules and within said channels accommodating movement of each of said modules along said line of travel.

4. A system according to claim 3, wherein said fixture includes a plurality of spaced-apart walls (52a-52c), opposing pairs of said walls defining said plurality of channels (54), each of said adaptor modules being disposed within a respective channel, and wherein said cooperating guides are on each of said walls for attaching said adaptor modules (58) to said walls.

5. A system according to claim 3 or claim 4, wherein said cooperating guides include a rail (64) on each of said adaptor modules and a mating groove (56) on at least one of said walls opposing each of said channels with said rails slidably received within said groove and with said rails sliding within said groove along said line of travel.

6. A system according to any one of the preceding claims, further comprising:

   a frame member (10) including a base with said frame member having means for supporting a plurality of said fixtures along a vertical length of said frame member; a plurality of said fixtures (26) being secured to said frame member; and a fiber guide (18) secured to said frame member for organizing fibers directed towards said adaptor modules.

7. A system according to any one of the preceding claims, wherein said longitudinal axis is vertically orientated.

8. A system according to any one of the preceding claims, wherein said adaptor modules (58) are split for said plurality of adaptors to include a first set and a second set of adaptors each separately movable along said respective line of travel.

9. A system according to any one of the preceding claims, further comprising a frame having mounting means for mounting said fixture in said frame; said mounting means including a pivot attachment for said fixture to pivot relative to said frame about said pivot axis.

10. A system according to claim 9, wherein said pivot axis is generally perpendicular to said line of travel.

11. A system according to claim 9 or claim 10, wherein said mounting means further includes a frame lock for releasably locking said fixture in any one of a plurality of pivoted positions about said pivot axis.

12. A high density, fiber optic distribution frame comprising a system according to claim 6 or any one of claims 7 to 11 when dependent on claim 6.

13. An adaptor module (58) arranged for mounting in a signal transmission cable management system having a fixture including a plurality of spaced apart

walls defining a plurality of parallel spaced apart cavities for receiving the modules, wherein said adaptor module (58) is of hollow construction and comprises a plurality of adaptors (90) mounted in a linear array defining a longitudinal axis for said module (58), each adaptor (90) having opposite ends for coupling to a cable connector, said module (58) being provided with means (64) for individually movably mounting the module on the fixture for movement along a line of travel generally parallel to said longitudinal axis, each one of said adaptors (90) being movable with said adaptor module (58) along said line of travel.

14. The use of a signal transmission cable management system as specified in any one of claims 1 to 11 to provide a high density of readily accessible fiber optic connector locations.

15. A method of connecting fiber optic cables in a signal transmission cable management system comprising:

providing a plurality of adaptor modules (58), each one of said adaptor modules (58) including a plurality of adaptors (90) mounted in a linear array defining a longitudinal axis for each of said modules, each adaptor (90) having opposite ends for coupling to a cable connector, and
mounting said plurality of adaptor modules (58) on a fixture (26) so that each of said adaptor modules is individually movably mounted on said fixture for movement along a line of travel, said modules being mounted on said fixture (26) in side-by-side relation with said longitudinal axes generally parallel to said line of travel, each one of said adaptors (90) being movable with said one of said modules along said line of travel;
coupling said opposite ends to a cable connector, thereby coupling fiber optic cables.

Patentansprüche

1. Verwaltungssystem für Signalübertragungskabel, welches folgendes umfasst:

eine Montagevorrichtung (26); und
eine Vielzahl von Adaptermodulen (58), die an der Montagevorrichtung angebracht sind, wobei jedes Modul einzeln bewegbar an der Montagevorrichtung zur Bewegung entlang einer Lauflinie (A) angebracht ist,

wobei jedes der Adaptermodule (58) eine Vielzahl von Adaptern (90) umfasst, jeder Adapter gegenüberliegende Enden zur Ankopplung an einen Kabelverbinder aufweist und jeder einzelne der Adapter (90) mit einem der Module entlang der Lauflinie bewegbar ist; und
wobei die Vielzahl der Adapter (90) in einer eine Längsachse für jedes der Module definierenden, linearen Anordnung angebracht sind, und die Module an der Montagevorrichtung nebeneinander bezüglich der Längsachse angebracht sind, die im Wesentlichen parallel zu der Lauflinie (A) ist.

2. System nach Anspruch 1, wobei jeder der Vielzahl der Adapter (90) erste und zweite Lichtleitfaserverbinder ankoppelt.

3. System nach einem der vorhergehenden Ansprüche, wobei die Montagevorrichtung (26) eine Vielzahl von Kanälen (54) definiert, jeder der Adaptermodule (58) in einem entsprechenden Kanal angeordnet ist, und ferner zusammenwirkende Führungen (56, 64) an jedem der Module umfasst und die Bewegung in den Kanälen jedes der Module entlang der Lauflinie anpasst.

4. System nach Anspruch 3, wobei die Montagevorrichtung eine Vielzahl von voneinander beabstandeten Wänden (52a- 52c) aufweist, die jeweils gegenüberliegenden Paare dieser Wände die Vielzahl von Kanälen (54) definieren, jeder der Adaptermodule in einem entsprechenden Kanal angeordnet ist und wobei die zusammenwirkenden Führungen an jeder der Wände sind, um die Adaptermodule (58) an die Wände anzubringen.

5. System nach einem der Ansprüche 3 oder 4, wobei die zusammenwirkenden Führungen an jeder der Adaptermodule eine Schiene (64) und eine korrespondierende Nut (56) an mindestens einer der an jedem der Kanäle gegenüberliegenden Wände beinhaltet, wobei die Kanäle mit den in den Nuten verschiebbar aufgenommen Schienen und mit den innerhalb der Nut entlang der Lauflinie verschiebbar angeordneten Schienen ausgestattet ist.

6. System nach einem der vorhergehenden Ansprüche, welches weiterhin folgendes umfasst:

ein eine Basis aufweisendes Rahmenelement (10), wobei das Rahmenelement tragende Mittel für eine Vielzahl der Montagevorrichtungen entlang der vertikalen Länge des Rahmenelementes aufweist; eine Vielzahl der Montagevorrichtungen (26) sind an dem Rahmenbauteil befestigt; und eine Faserführung (18), die an dem Rahmenelement befestigt ist, um die zu den Adaptermodulen orientierten Fasern einzuordnen.

7. System nach einem der vorhergehenden Ansprüche, wobei die Längsachse vertikal ausgerichtet ist.

8. System nach einem der vorhergehenden Ansprüche, wobei die Adaptermodule (58) für die Vielzahl von Adaptern aufgeteilt sind, um einen ersten Satz und einen zweiten Satz von Adaptern, die jeweils getrennt voneinander entlang der entsprechenden Lauflinie bewegbar sind, aufzunehmen.

9. System nach einem der vorhergehenden Ansprüche, welches weiterhin einen Rahmen mit Montagemitteln zur Befestigung der Montagevorrichtung an den Rahmen umfasst;
die Montagemittel eine Schwenkbefestigung für die Montagevorrichtung aufweisen, um diese relativ zum Rahmen um die Schwenkachse zu verschwenken

10. System nach Anspruch 9, wobei die Schwenkachse im Wesentlichen senkrecht zur Lauflinie ist.

11. System nach einem der Ansprüche 9 oder 10, wobei die Montagemittel weiterhin eine Rahmenverschlussvorrichtung aufweisen, um die Montagevorrichtung in irgendeiner der Vielzahl der verschwenkten Positionen um die Schwenkachse lösbar zu verschließen.

12. Hauptverteiler für eine hohe Dichte von Lichtleitfasern umfassend ein System nach einem der Ansprüche 6 oder 7 bis 11, wenn diese von Anspruch 6 abhängig sind.

13. Adaptermodul (58) zur Befestigung in einem Verwaltungssystem für Signalübertragungskabel mit einer Montagevorrichtung, die eine Vielzahl von voneinander beabstandeten, eine Vielzahl von zueinander parallelen und voneinander beabstandeten Ausnehmungen zur Aufnahme der Module definierenden Wänden umfasst, wobei das Adaptermodul (58) eine Hohlkonstruktion ist und eine Vielzahl von Adaptem (90) umfasst, die in einer eine Längsachse für das Modul (58) definierenden linearen Anordnung befestigt sind, jeder Adapter (90) gegenüberliegende Enden zur Ankopplung an einen Kabelverbinder aufweist, das Modul (58) mit Mitteln (64) zur individuell beweglichen Befestigung des Moduls an der Montagevorrichtung zur Bewegung entlang der Lauflinie, die im Wesentlichen parallel zur Längsachse ist, ausgestattet ist, wobei jeder einzelne der Adapter (90) mit dem Adaptermodul (58) entlang der Lauflinie bewegbar ist.

14. , Verwendung des Verwaltungssystems für Signalübertragungskabel gemäß einem der vorgehenden Ansprüche 1 - 11, um eine hohe Dichte von sofort zugänglichen Lichtleitfaserverbindungsstellen zur Verfügung zu stellen.

15. Verfahren zur Verbindung zur Lichtleitfaserkabeln in einem Verwaltungssystem für Signalübertragungskabel umfassend folgende Schritte:

Zurverfügungstellen einer Vielzahl von Adaptermodulen (58), wobei jedes der Adaptermodule (58) eine Vielzahl von Adaptern (90), die in einer eine Längsachse für jedes der Module definierenden linearen Anordnung befestigt sind, jeder Adapter (90) gegenüberliegende Enden zur Ankopplung an einen Kabelverbinder aufweist und
Befestigen der Vielzahl von Adaptermodulen (58) an einem Montagevorrichtung (26), so dass jedes der Adaptermodule individuell bewegbar an der Montagevorrichtung zur Bewegung entlang der Lauflinie befestigt ist, wobei die Module an der Montagevorrichtung (26) nebeneinander in Bezug zur Längsachse, die im Wesentlichen parallel zur Lauflinie ist, befestigt sind und jeder der Adapter (90) mit einem der Module entlang der Lauflinie bewegbar ist;
Ankopplung der gegenüberliegenden Enden an einen Kabelverbinder, wodurch die Lichtleitfaserkabeln angekoppelt werden.

Revendications

1. Système de gestion de câble de transmission de signal comprenant :

un dispositif fixe (26), et
une pluralité de modules d'adaptateurs (58) montés sur ledit dispositif fixe, chaque module étant monté de manière individuelle de façon à pouvoir se déplacer sur ledit dispositif fixe (26) pour un mouvement le long d'une ligne de trajet (A),

dans lequel chacun desdits modules d'adaptateurs (58) comprend une pluralité d'adaptateurs (90), chaque adaptateur possédant des extrémités opposées pour se coupler à un connecteur de câbles et chacun desdits adaptateurs (90) pouvant se déplacer avec l'un desdits modules le long de ladite ligne de trajet ; et
dans lequel ladite pluralité d'adaptateurs (90) est montée dans une rangée linéaire définissant un axe longitudinal pour chacun desdits modules, et lesdits modules sont montés sur ledit dispositif fixe dans une relation côte à côte avec lesdits axes longitudinaux généralement parallèles à ladite ligne de trajet (A).

2. Système selon la revendication 1, dans lequel cha-

que adaptateur parmi ladite pluralité d'adaptateurs (90) couple des premier et deuxième connecteurs de câble de fibres optiques.

3. Système selon l'une quelconque des revendications précédentes, dans lequel ledit dispositif fixe (26) définit une pluralité de canaux (54), chacun desdits modules d'adaptateurs (58) étant disposé à l'intérieur d'un canal respectif et comprenant en outre des guides de coopération (56, 64) sur chacun desdits modules et dans lesdits canaux s'adaptant à un mouvement desdits modules le long de ladite ligne de trajet.

4. Système selon la revendication 3, dans lequel ledit dispositif fixe comprend une pluralité de parois espacées (52a-52c), les paires opposées desdites parois définissant ladite pluralité de canaux (54), chacun desdits modules d'adaptateurs étant disposé à l'intérieur d'un canal respectif, et dans lequel lesdits guides de coopération sont situés sur chacune desdites parois pour attacher lesdits modules d'adaptateurs (58) auxdites parois.

5. Système selon la revendication 3 ou 4, dans lequel lesdits guides de coopération comprennent un rail (64) sur chacun desdits modules d'adaptateurs et une rainure de correspondance (56) sur au moins une desdites parois opposant chacun desdits canaux avec lesdits rails reçus de manière coulissante à l'intérieur de ladite rainure et avec lesdits rails coulissant à l'intérieur de ladite rainure le long de ladite ligne de trajet.

6. Système selon l'une quelconque des revendications précédentes, comprenant en outre :

un élément de cadre (10) comprenant une base avec ledit élément de cadre ayant des moyens pour supporter une pluralité desdits dispositifs fixes le long d'une longueur verticale dudit élément de cadre ; une pluralité desdits dispositifs fixes (26) étant fixés audit élément de cadre ; et un guide de fibres (18) fixé audit élément de cadre pour organiser des fibres dirigées vers lesdits modules d'adaptateurs.

7. Système selon l'une quelconque des revendications précédentes, dans lequel ledit axe longitudinal est orienté verticalement.

8. Système selon l'une quelconque des revendications précédentes, dans lequel lesdits modules d'adaptateurs (58) sont divisés pour que ladite pluralité d'adaptateurs comprenne un premier ensemble et un deuxième ensemble d'adaptateurs chacun pouvant bouger séparément le long de ladite ligne de trajet respective.

9. Système selon l'une quelconque des revendications précédentes, comprenant en outre un cadre ayant des moyens de montage pour monter ledit dispositif fixe dans ledit cadre ;

lesdits moyens de montage comprenant un pivot d'attache pour que ledit dispositif fixe puisse pivoter par rapport audit cadre autour dudit axe de pivot.

10. Système selon la revendication 9, dans lequel ledit axe de pivot est généralement perpendiculaire à ladite ligne de trajet.

11. Système selon la revendication 9 ou 10, dans lequel lesdits moyens de montage comprennent en outre un verrou de cadre pour verrouiller de façon à pouvoir être libéré ledit dispositif fixe dans n'importe quelle position parmi une pluralité de positions autour dudit axe de pivot.

12. Cadre de distribution de fibres optiques à haute densité comprenant un système selon la revendication 6 ou selon l'une quelconque des revendications 7 à 11 lorsque celles-ci dépendent de la revendication 6.

13. Module d'adaptateurs (58) agencé pour un montage dans un système de gestion de câble de transmission de signal ayant un dispositif fixe comprenant une pluralité de parois espacées définissant une pluralité de cavités espacées et parallèles pour recevoir les modules, dans lequel ledit module d'adaptateurs (58) est d'une construction creuse et comprend une pluralité d'adaptateurs (90) montée sur une rangée linéaire définissant un axe longitudinal pour ledit module (58), chaque adaptateur (90) possédant des extrémités opposées pour se coupler à un connecteur de câbles, ledit module (58) étant équipé de moyens (64) pour monter le module de manière individuelle de façon à pouvoir se déplacer sur le dispositif fixe pour un mouvement le long d'une ligne de trajet généralement parallèle audit axe longitudinal, chacun desdits adaptateurs (90) pouvant se déplacer avec ledit module d'adaptateurs (58) le long de ladite ligne de trajet.

14. Utilisation d'un système de gestion de câble de transmission de signal, comme spécifié dans l'une quelconque des revendications 1 à 11, pour fournir une grande densité d'emplacements de connexion de fibres optiques facilement accessibles.

15. Procédé pour connecter des câbles de fibres optiques dans un système de gestion de câble de transmission de signal comprenant les étapes consistant à :

fournir une pluralité de modules d'adaptateurs

(58), chacun desdits modules d'adaptateurs (58) comprenant une pluralité d'adaptateurs (90) montée sur une rangée linéaire définissant un axe longitudinal pour chacun desdits modules, chaque adaptateur (90) possédant des extrémités opposées pour se coupler à un connecteur de câbles, et

monter ladite pluralité de modules d'adaptateurs (58) sur un dispositif fixe (26) de sorte que chacun desdits modules d'adaptateurs soit monté de manière individuelle de façon à pouvoir se déplacer sur ledit dispositif fixe pour un mouvement le long d'une ligne de trajet, lesdits modules étant montés sur ledit dispositif fixe (26) dans une relation côte à côte avec lesdits axes longitudinaux généralement parallèles à ladite ligne de trajet, chacun desdits adaptateurs (90) pouvant se déplacer avec ledit un desdits modules le long de ladite ligne de trajet ;

coupler lesdites extrémités opposées à un connecteur de câbles, couplant ainsi des câbles de fibres optiques.

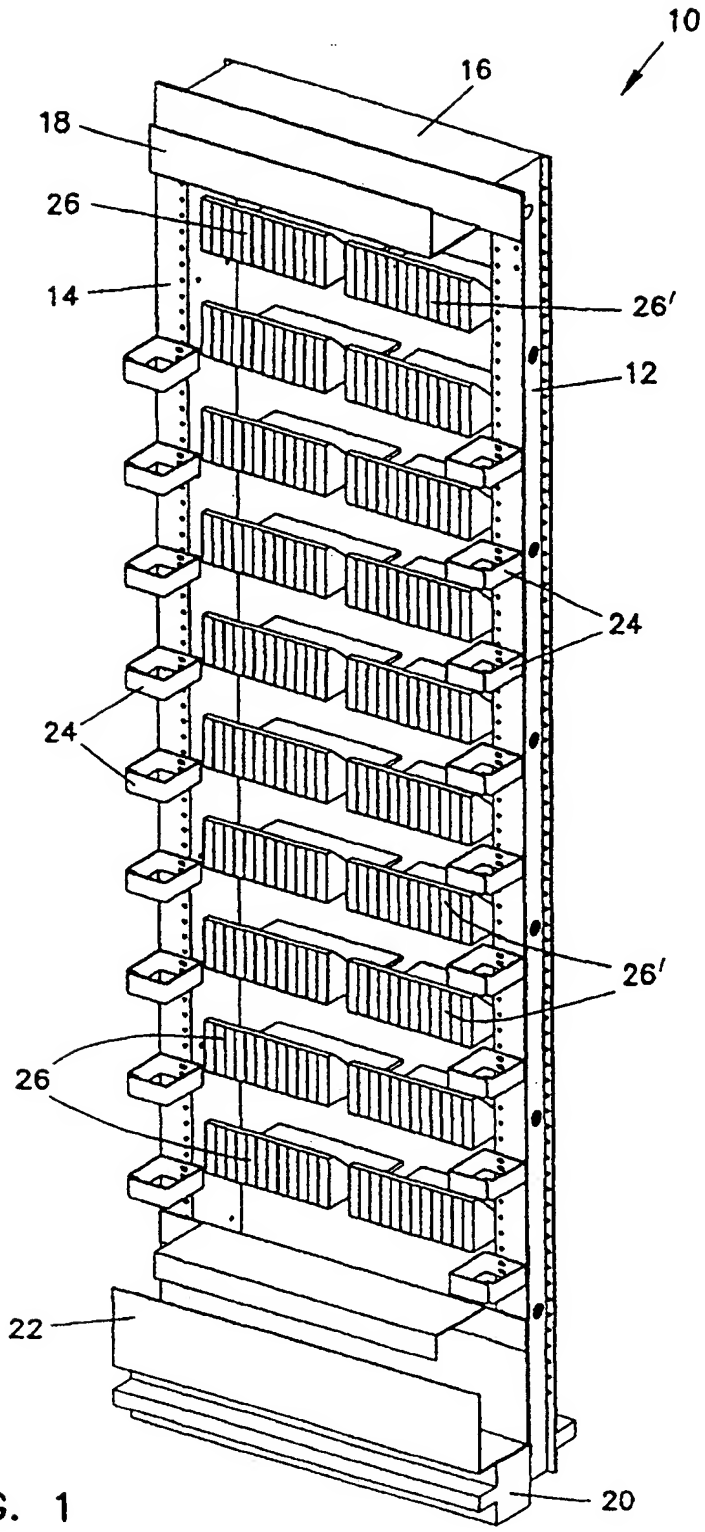

FIG. 1

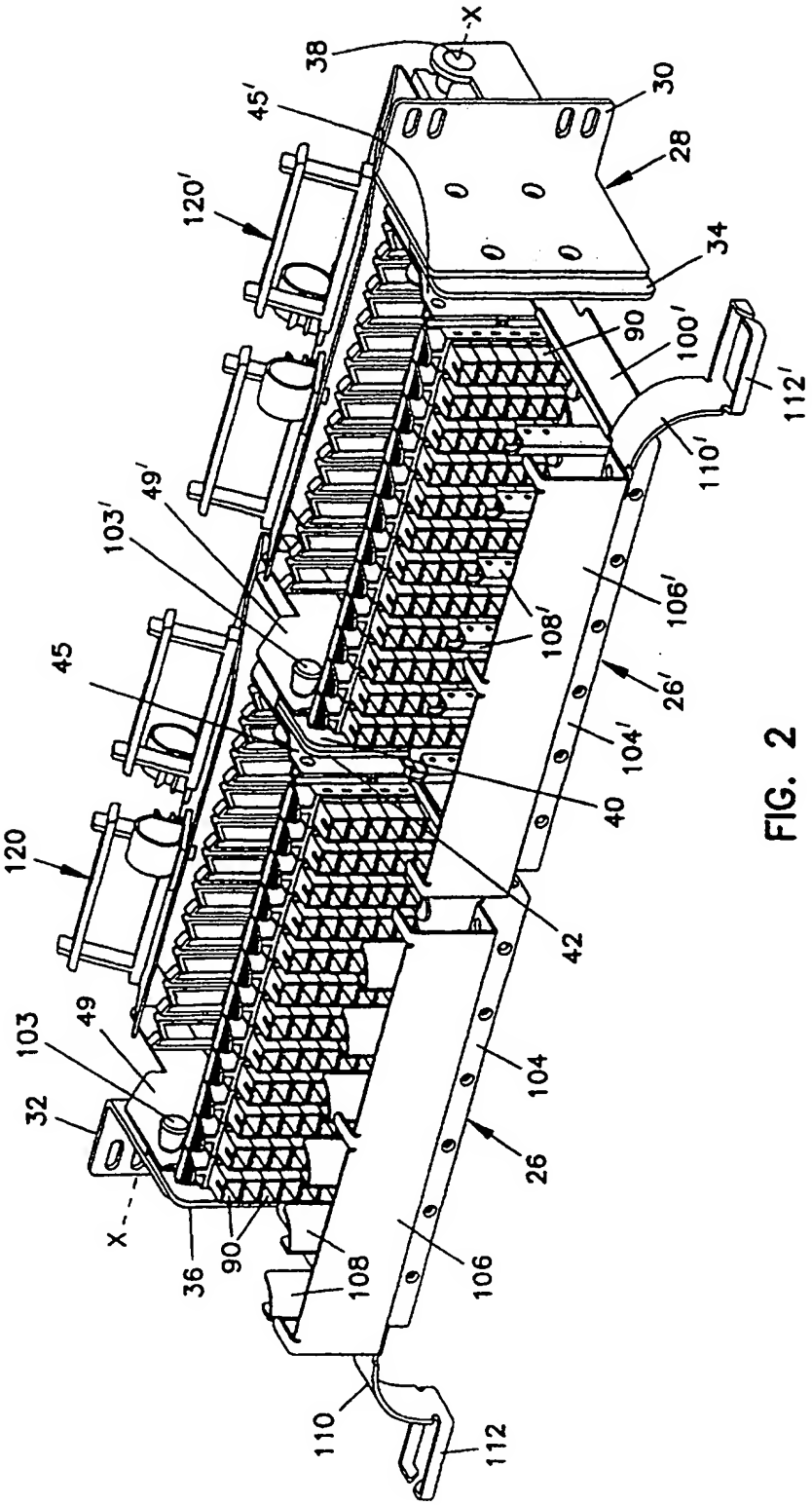
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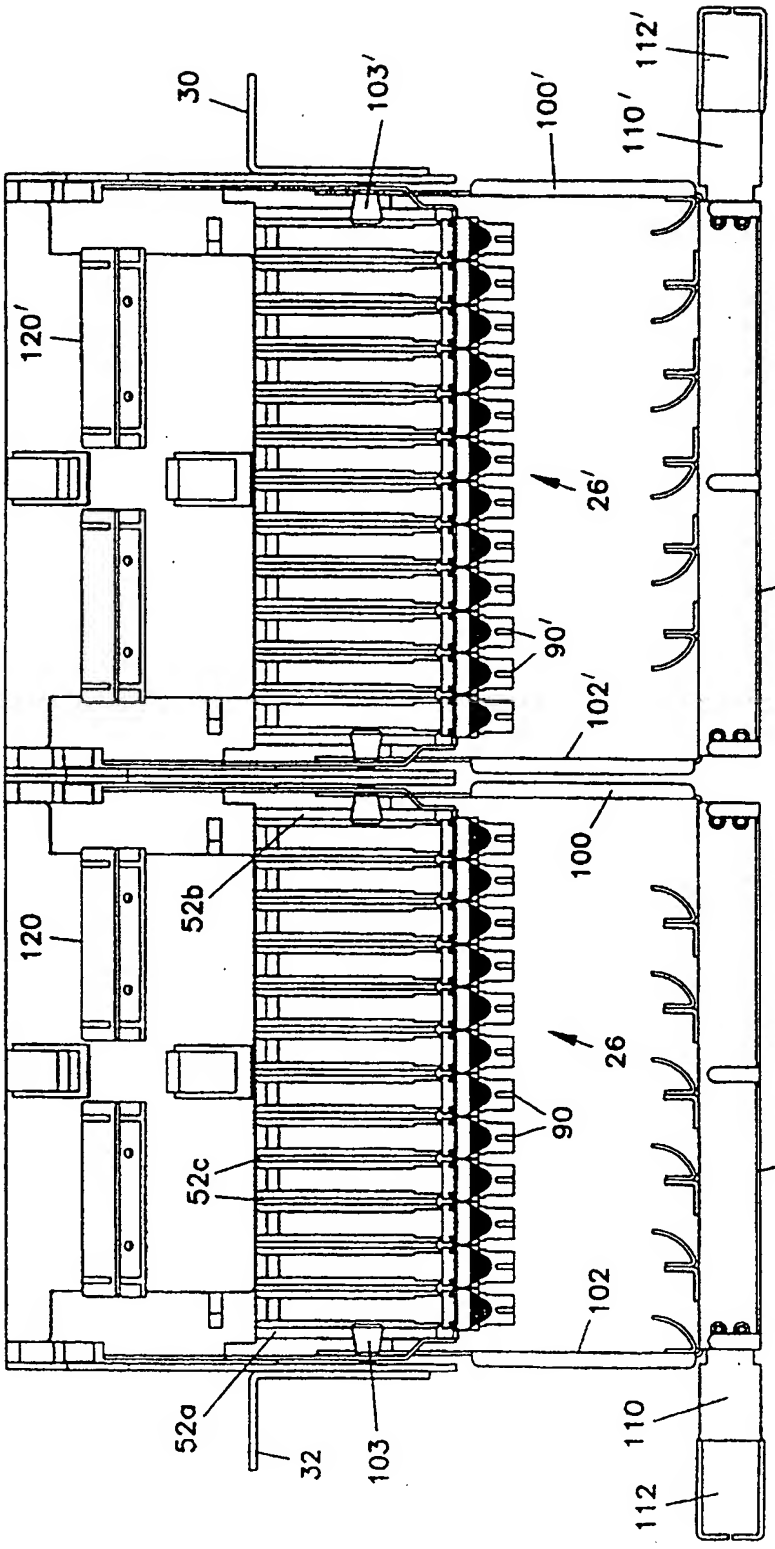
FIG. 2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100'
110'
112'
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26'
106'
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102'
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90
52c
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102
52a
32
103
110
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FIG. 3

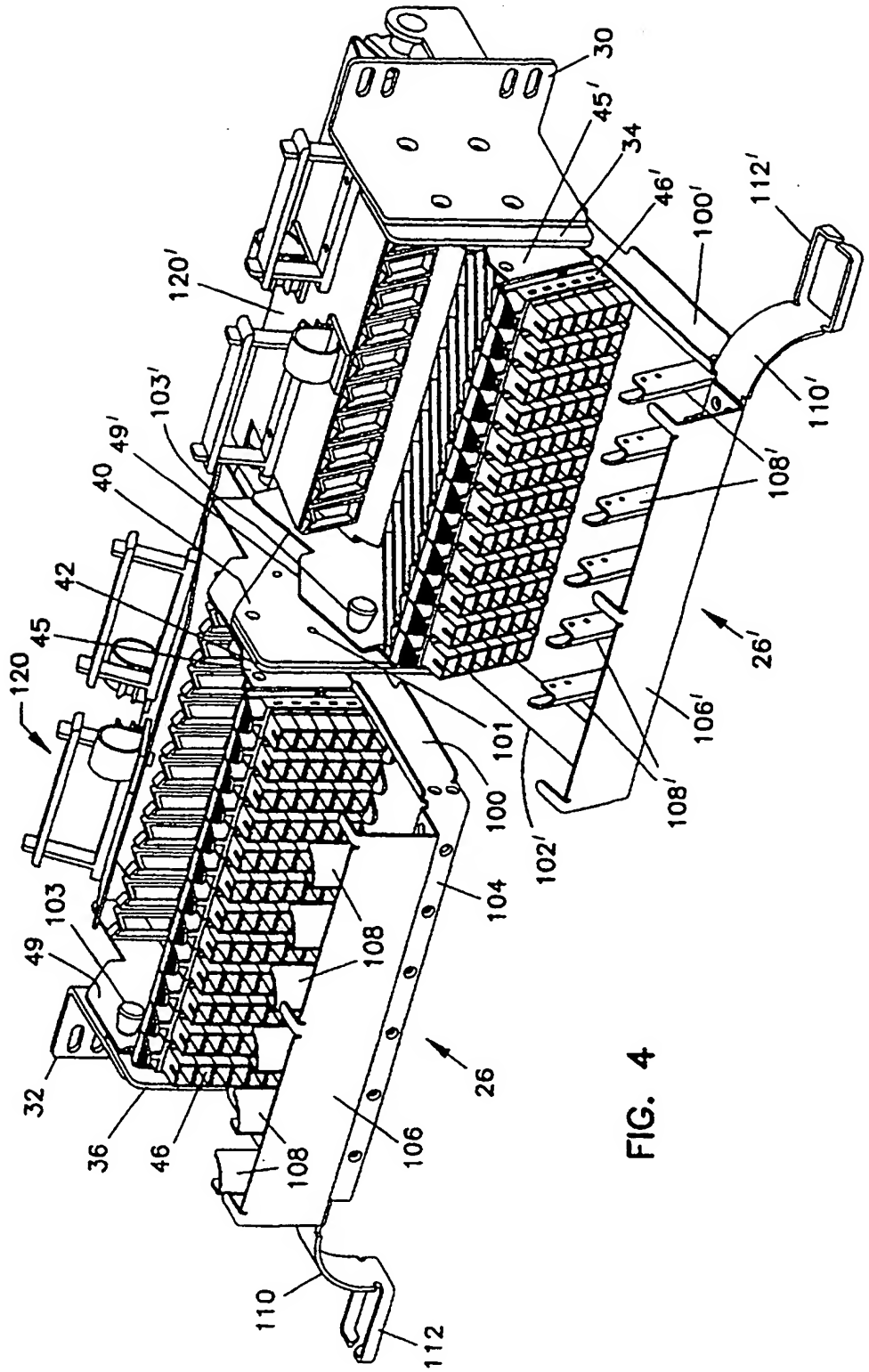
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FIG. 4

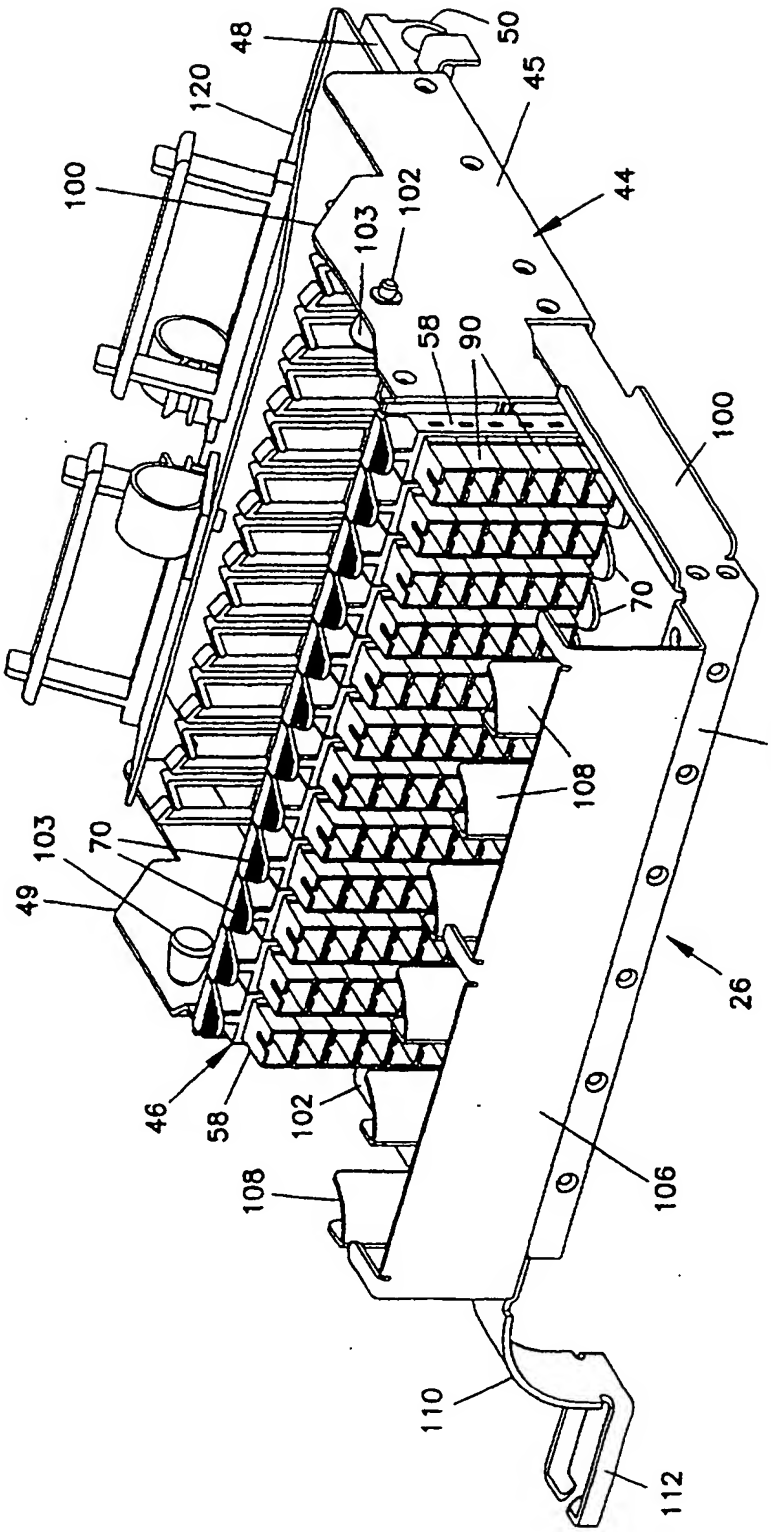
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FIG. 5

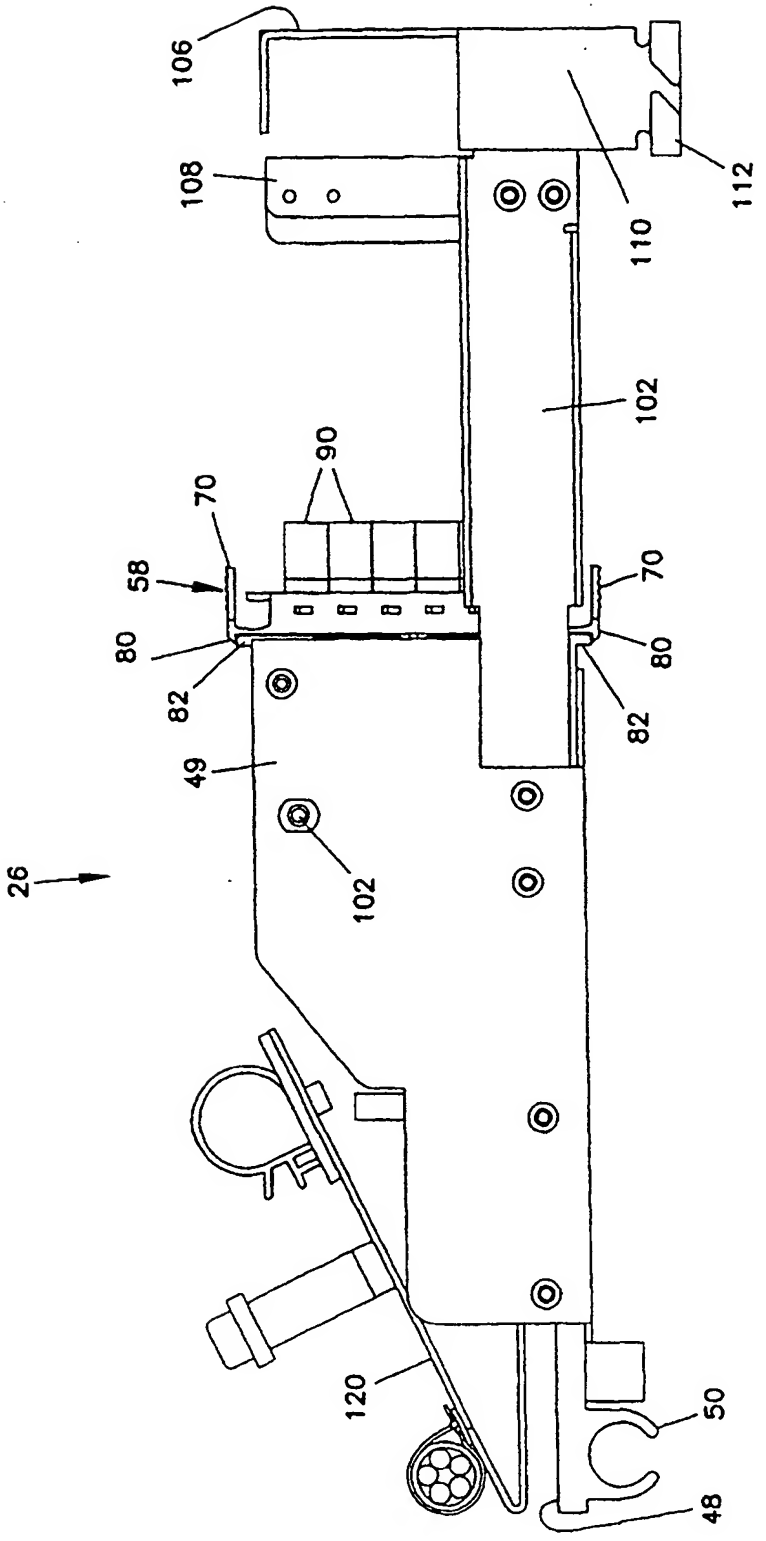

FIG. 6

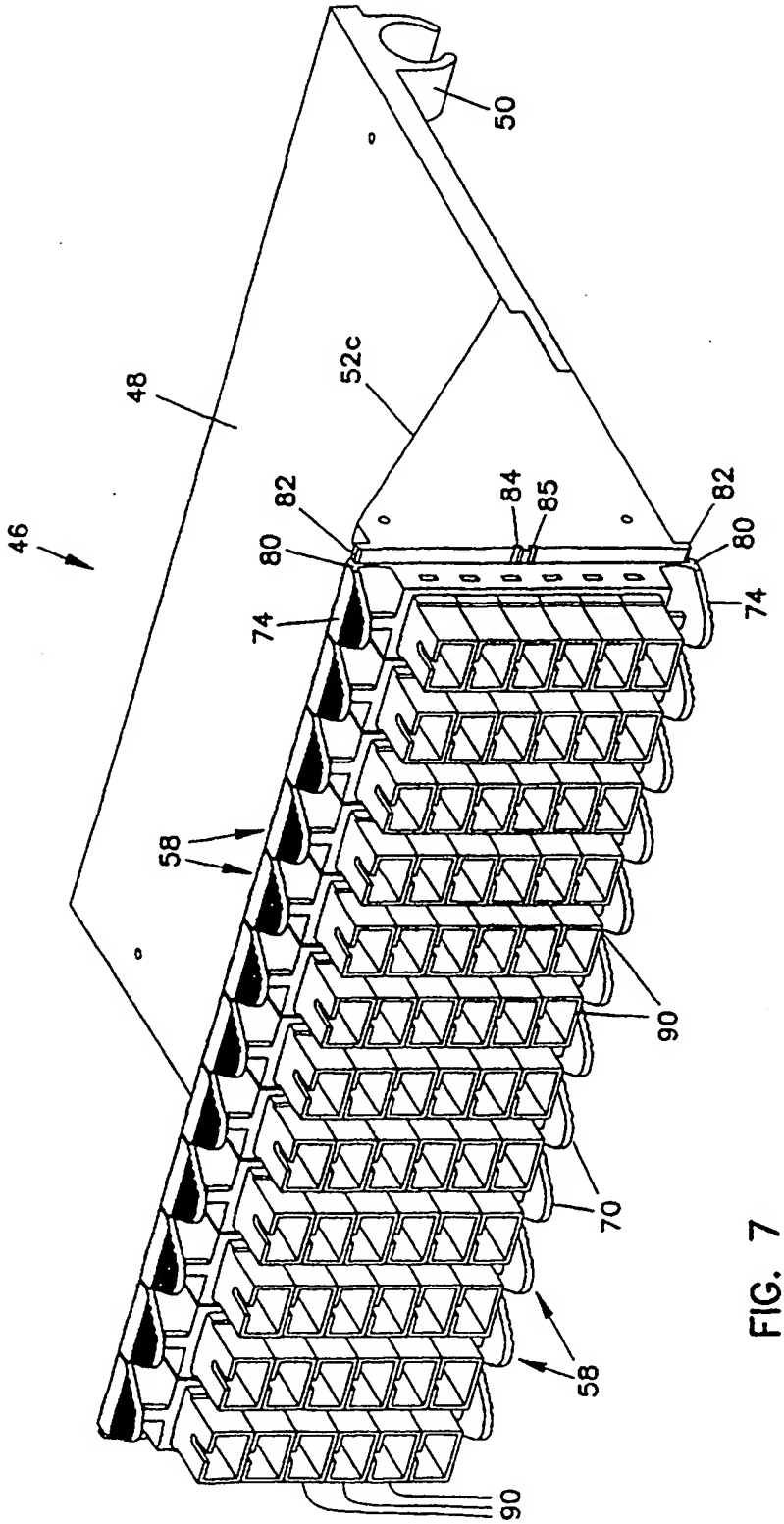

FIG. 7

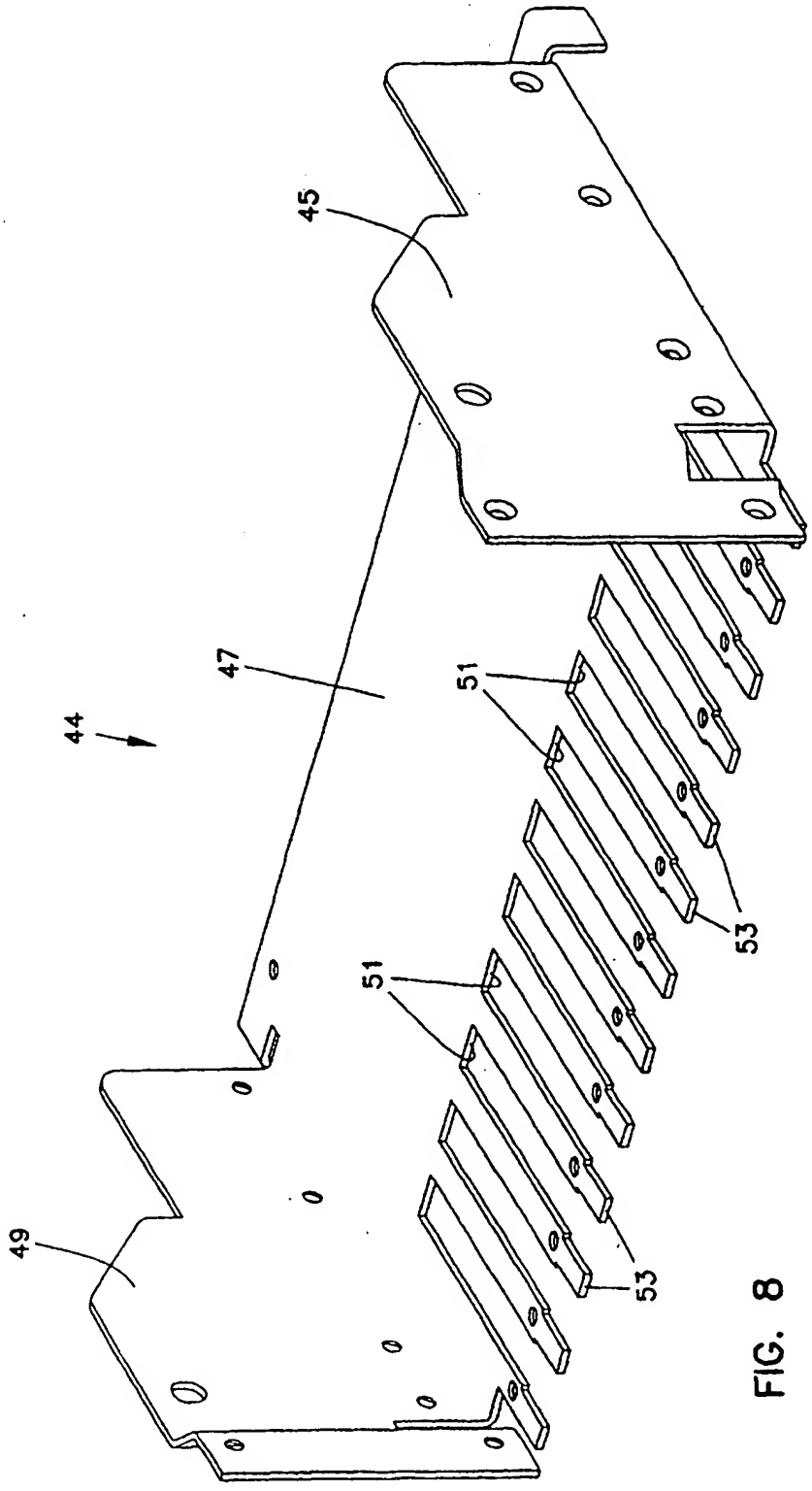

FIG. 8

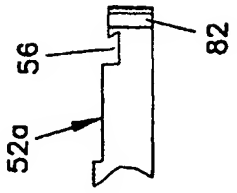

FIG. 11

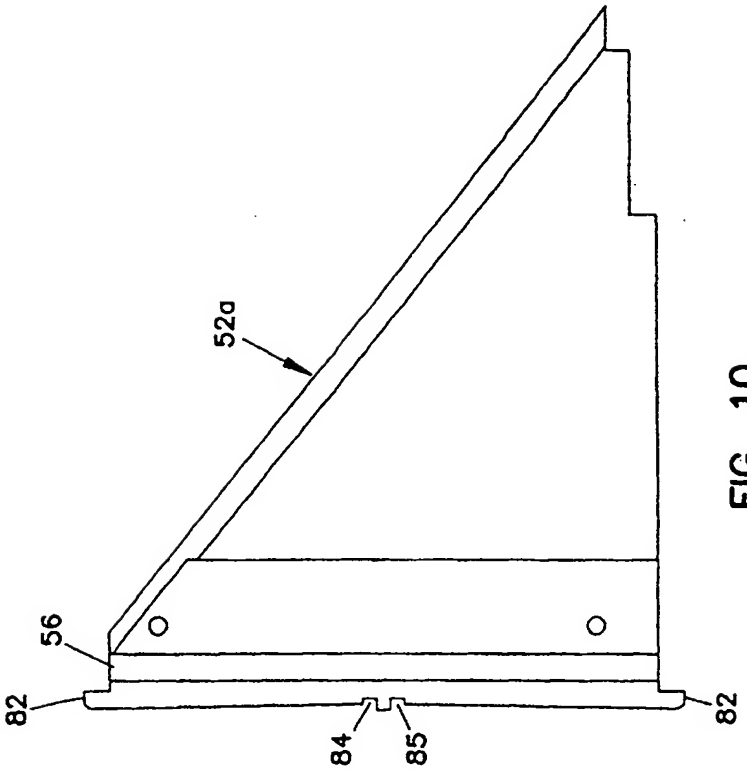

FIG. 10

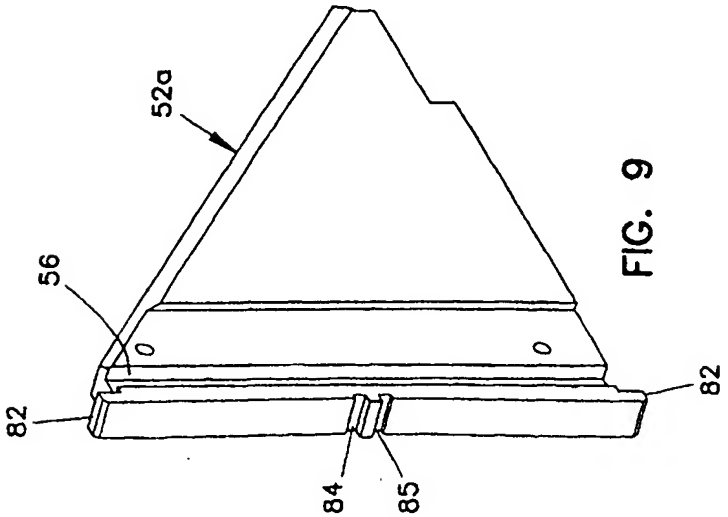

FIG. 9

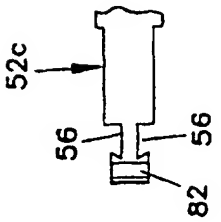

FIG. 14

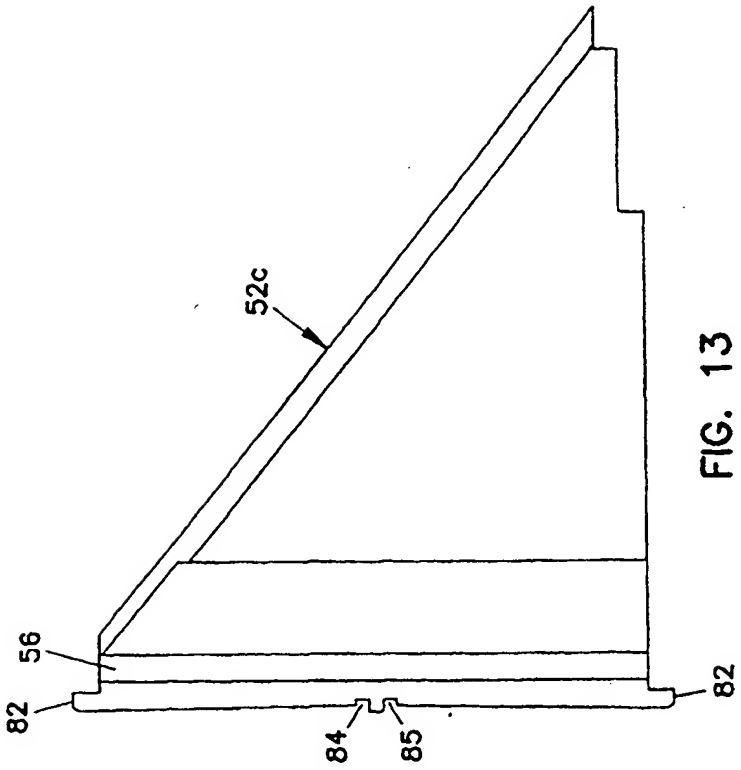

FIG. 13

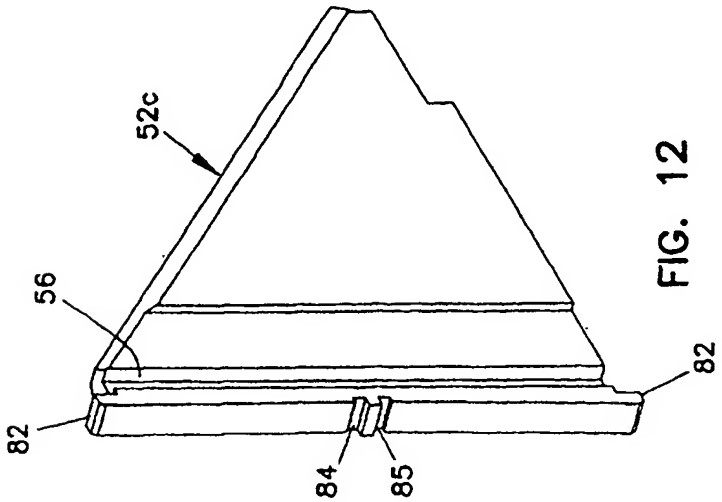

FIG. 12

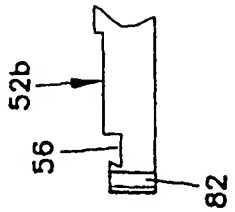

FIG. 17

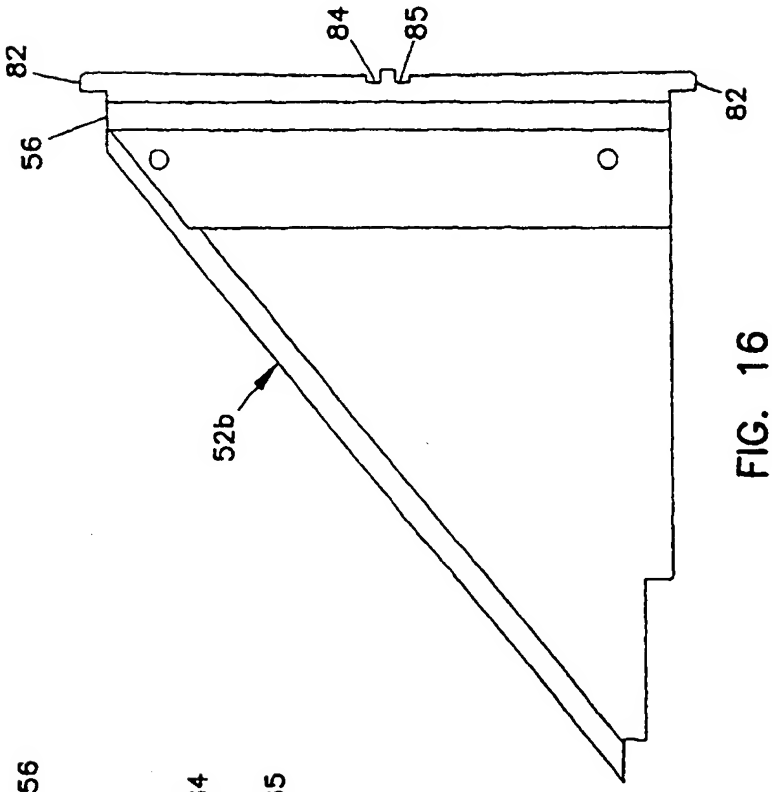

FIG. 16

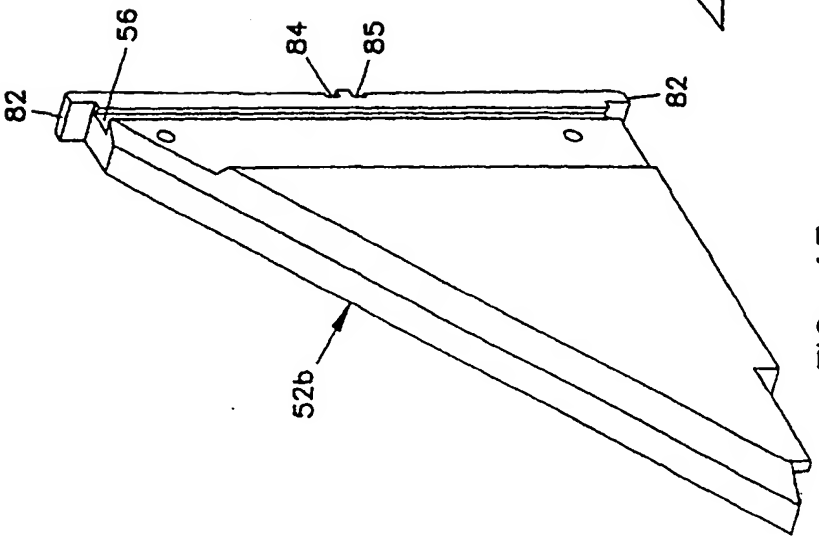

FIG. 15

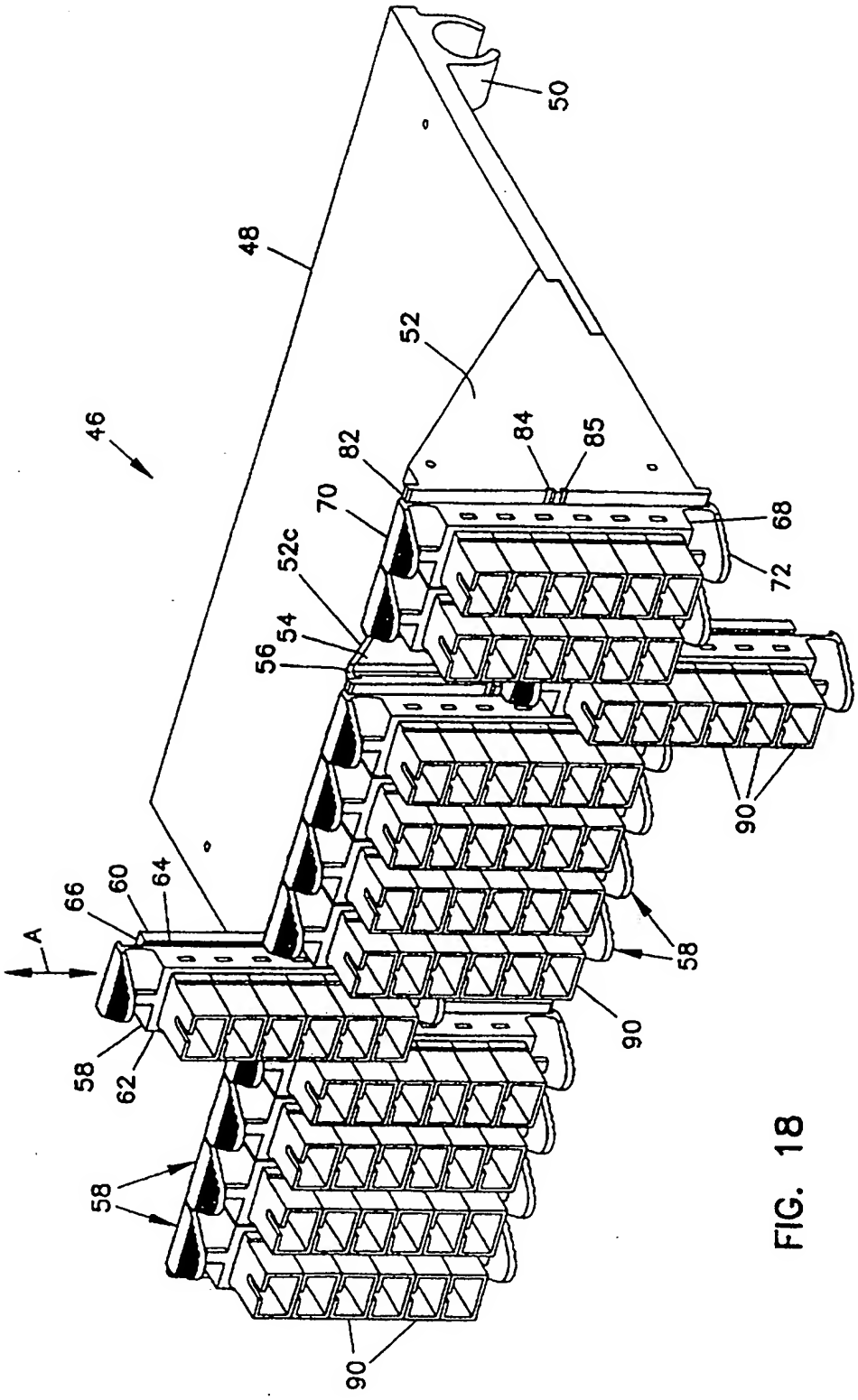

FIG. 18

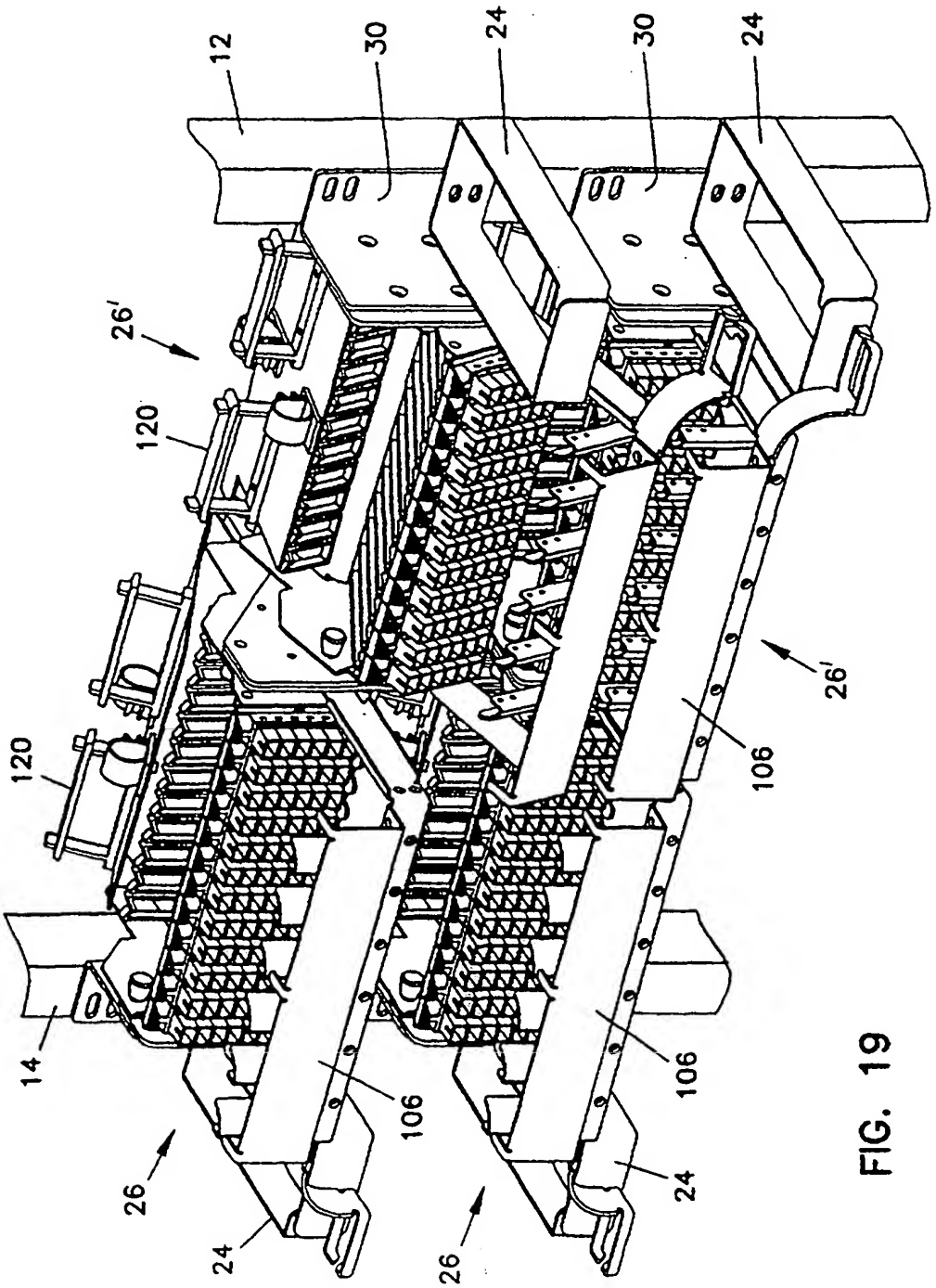

FIG. 19

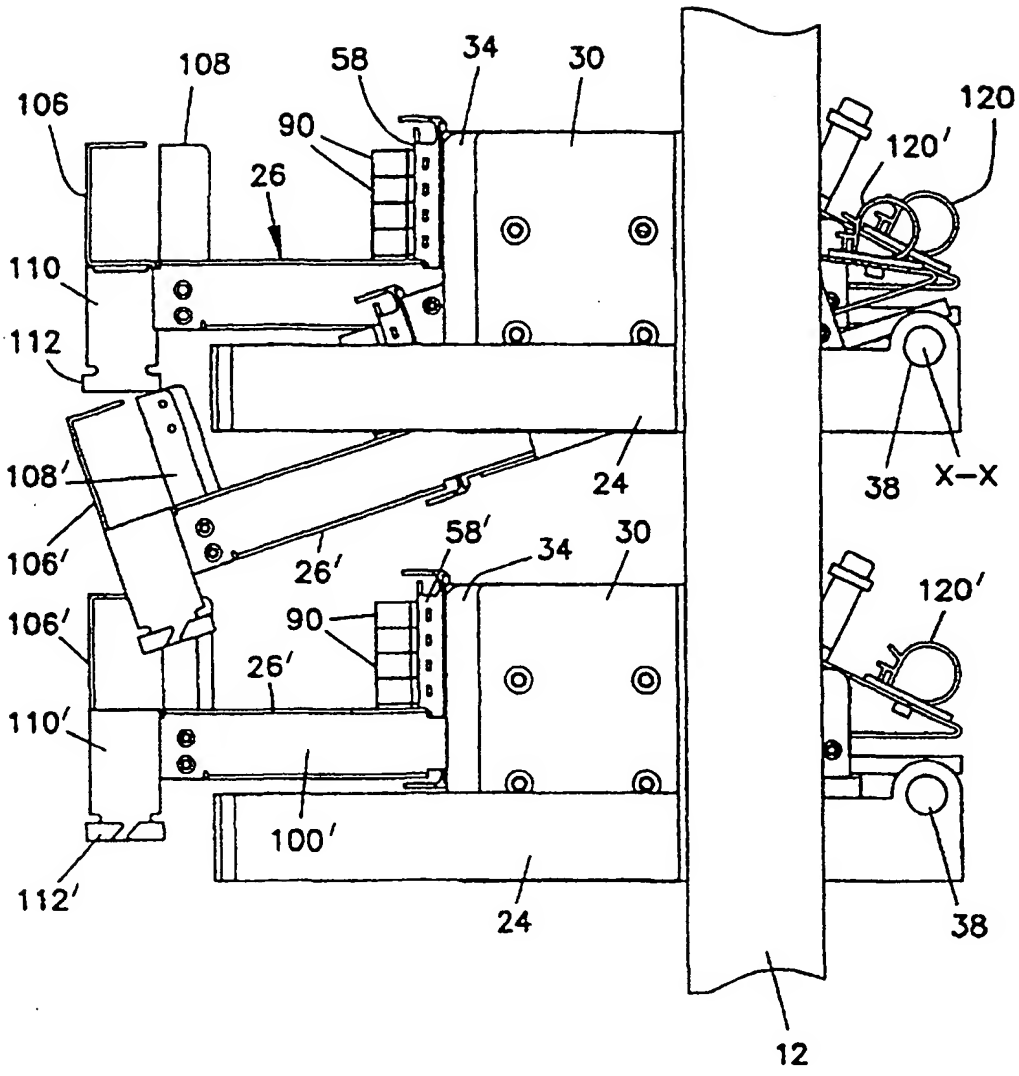
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FIG. 20

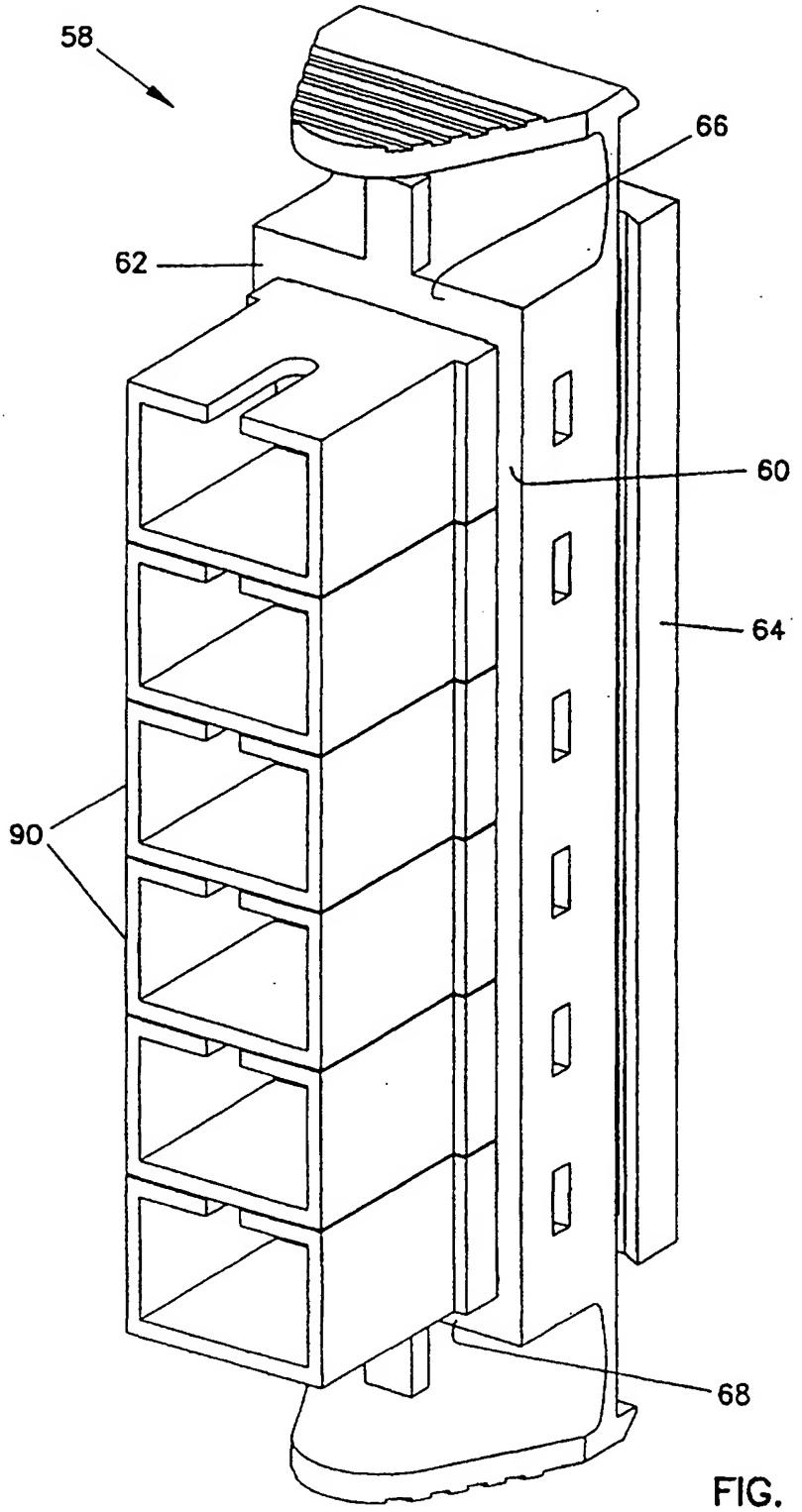

FIG. 21

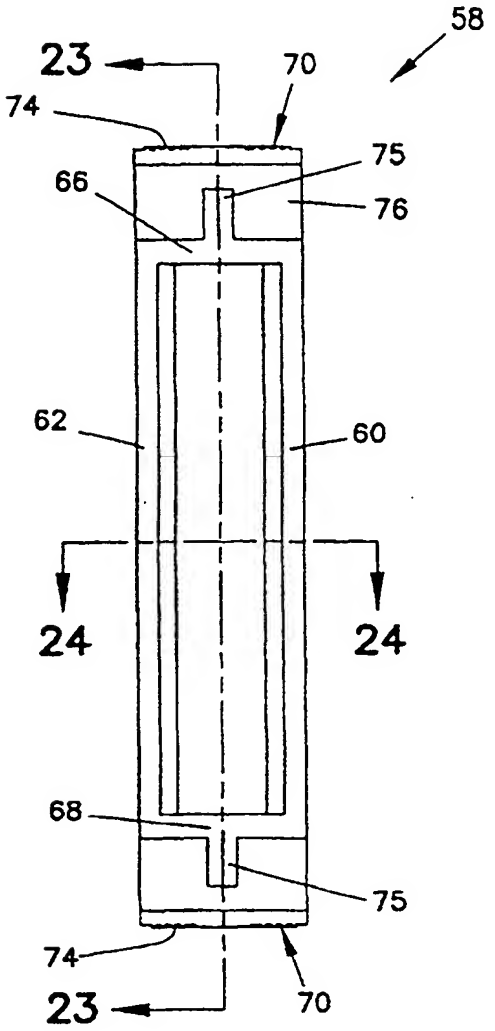

FIG. 22

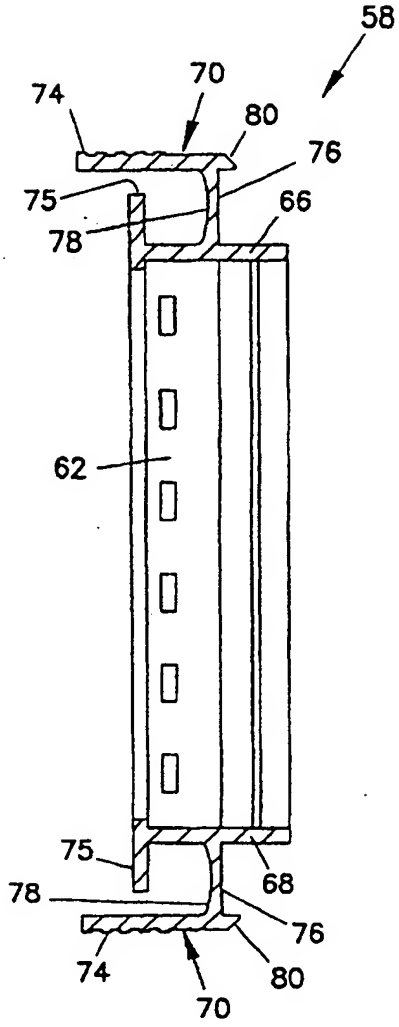

FIG. 23

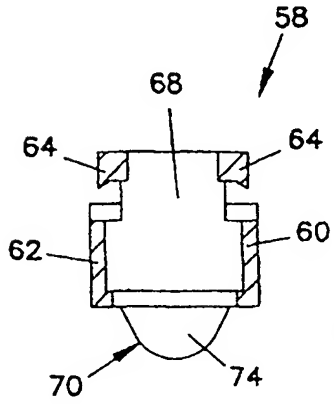

FIG. 24

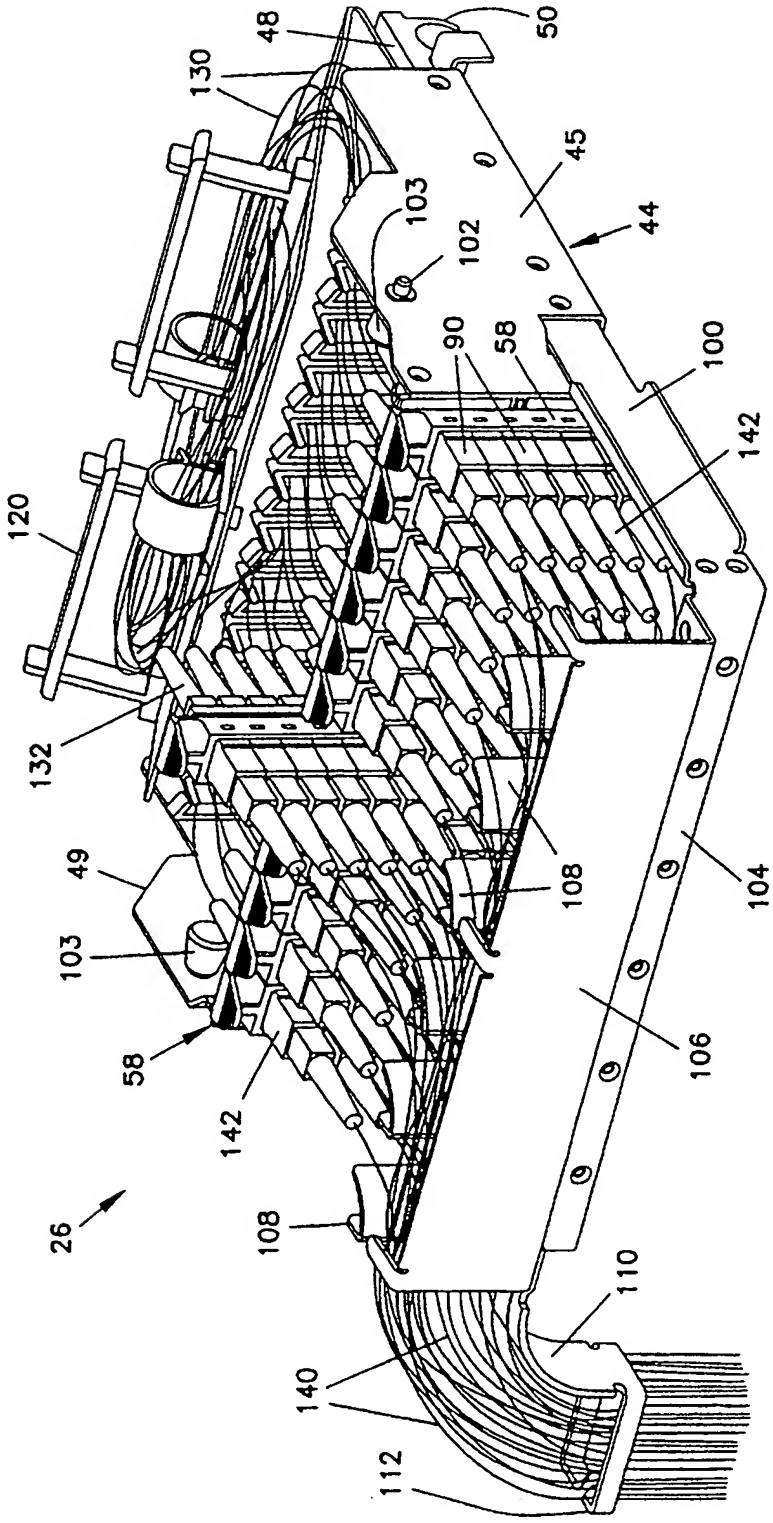
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FIG. 25

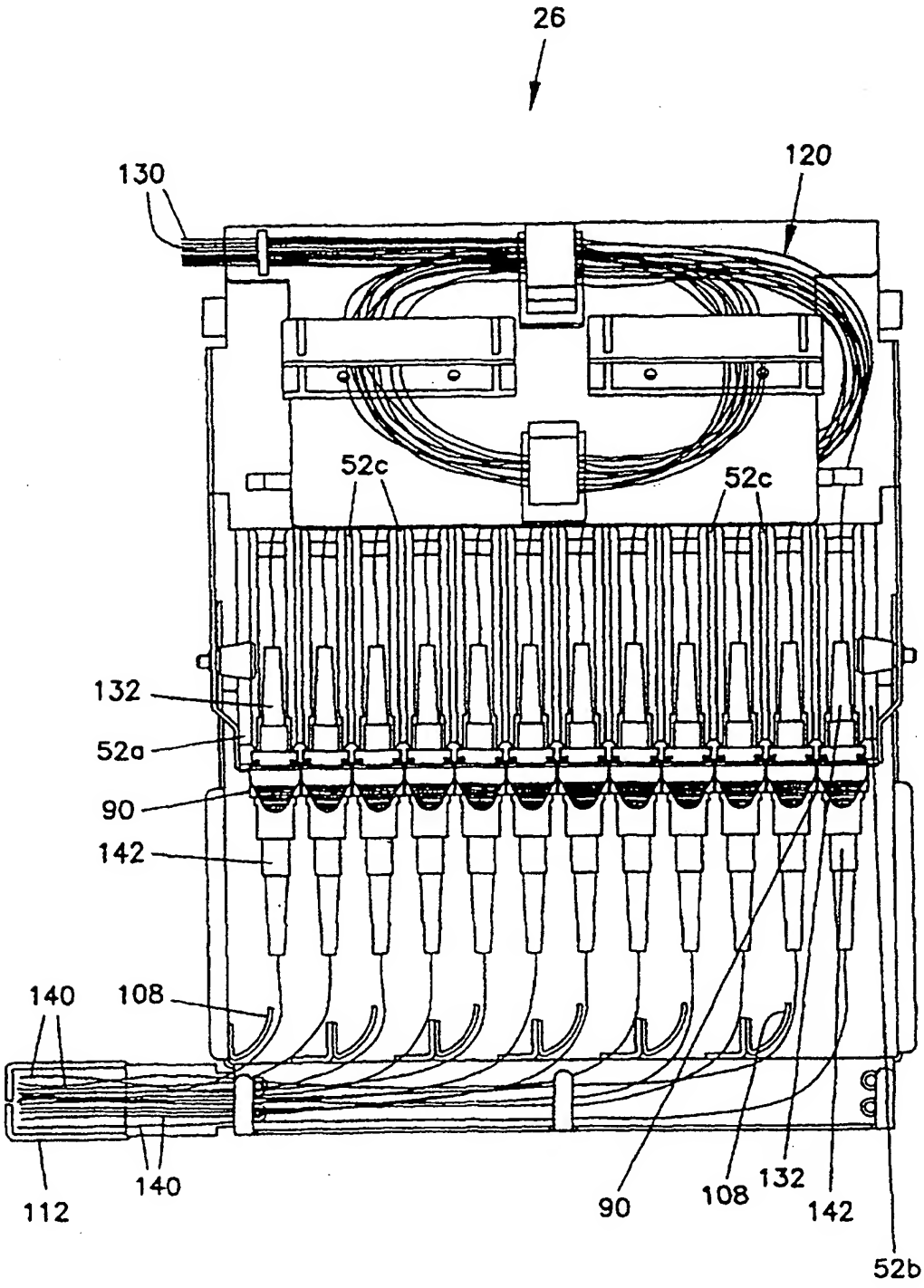
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FIG. 26